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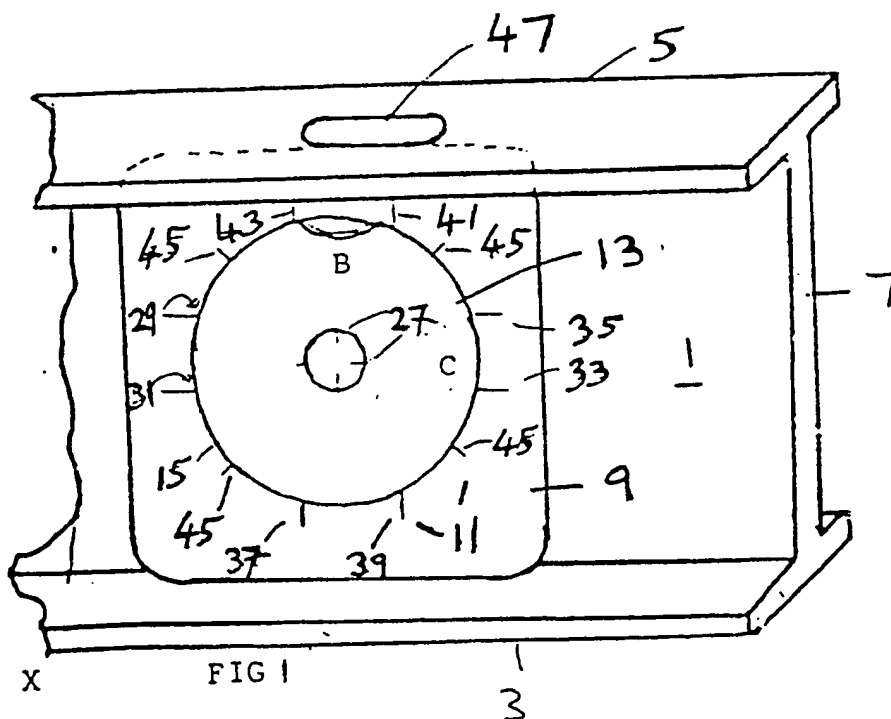
(71) Applicant  
John Thomas  
8 Deeley Road, Ystalyfera, Swansea,  
West Glam, SA9 2LW, United Kingdom

(72) Inventor  
John Thomas

(74) Agent and/or Address for Service  
Urquhart-Dykes & Lord  
Alexandra House, Alexandra Road, Swansea,  
West Glamorgan, SA1 5ED, United Kingdom

(54) Spirit levels

(57) A spirit level of 'I' beam cross section having a sealed fluid/bubble container mounted thereon, the construction of the container and markings provided on the spirit level enable it to be used selectively to give one or two-dimensional indications of spirit level inclination relative to the horizontal or vertical. The container 13 is disc shaped and edge markings enable the longitudinal length of the 'I' beam to be set horizontally or vertically, and central markings 27 enable the web 7 of the 'I' beam to be set in a horizontal plane.



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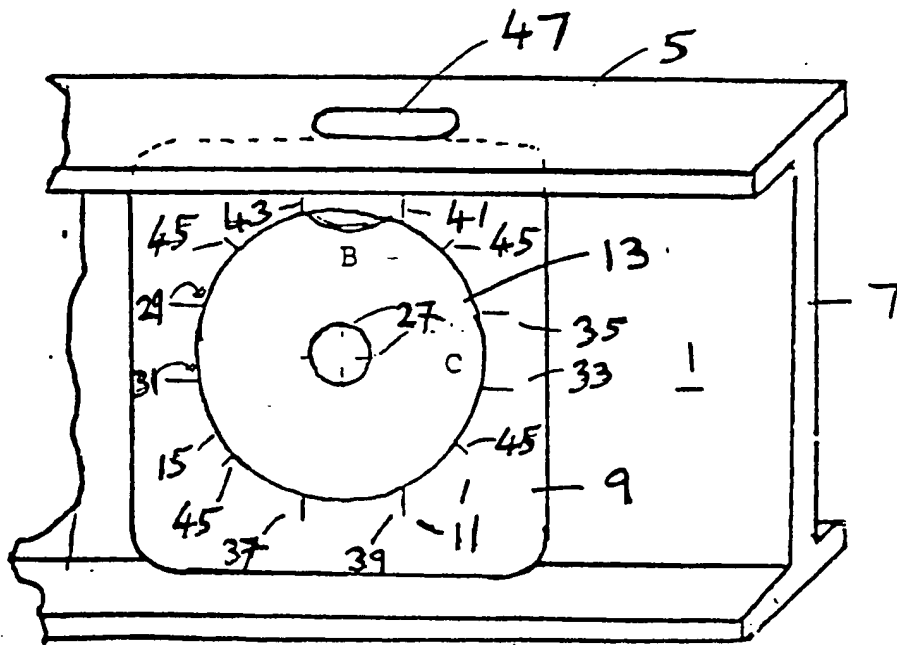


FIG 1

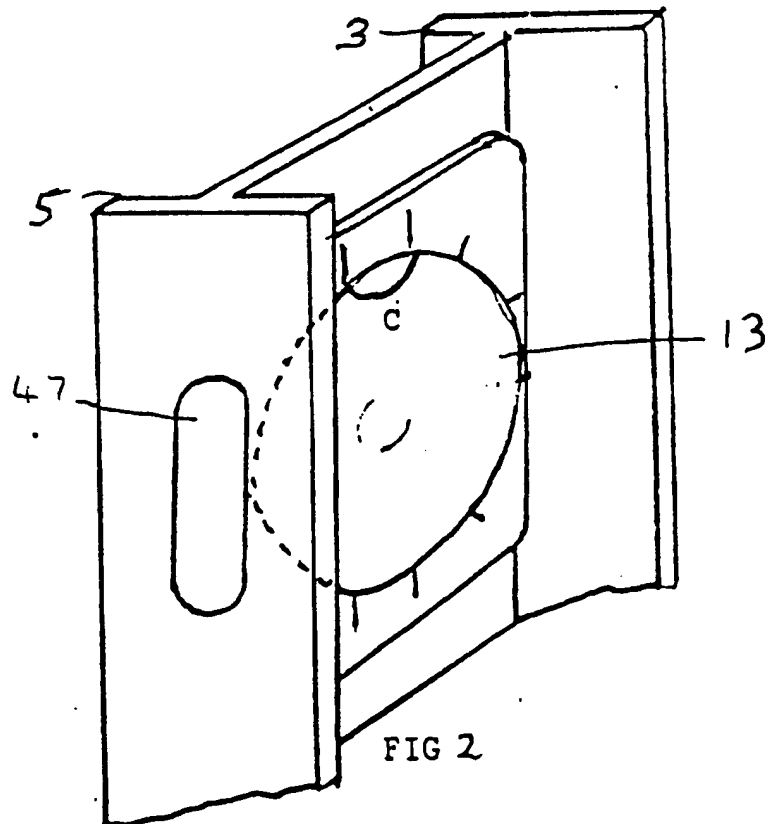


FIG 2

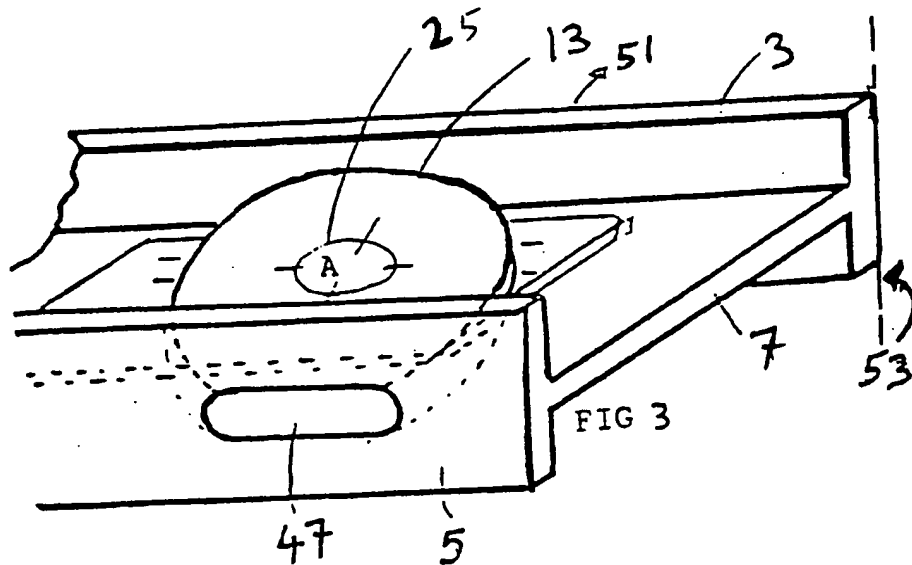
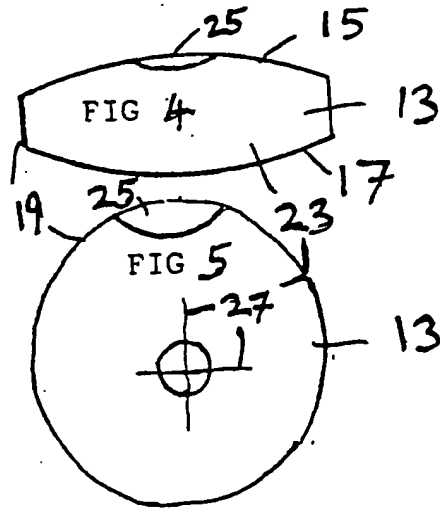
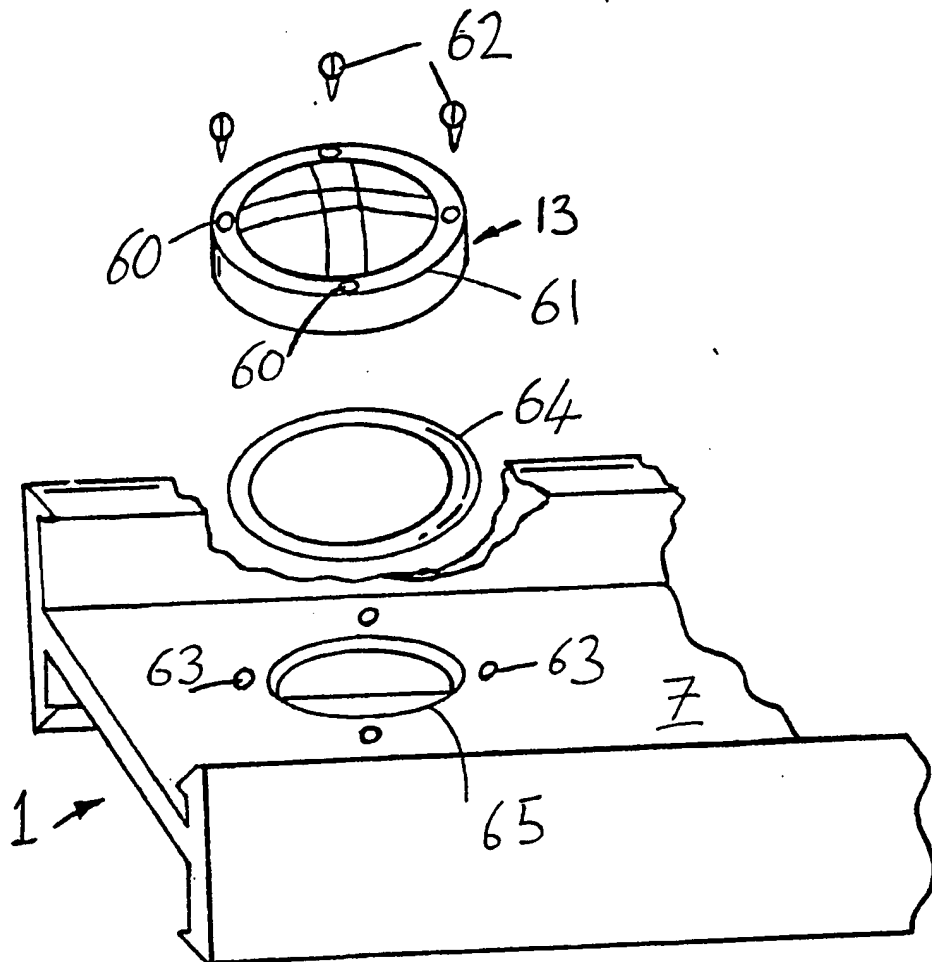
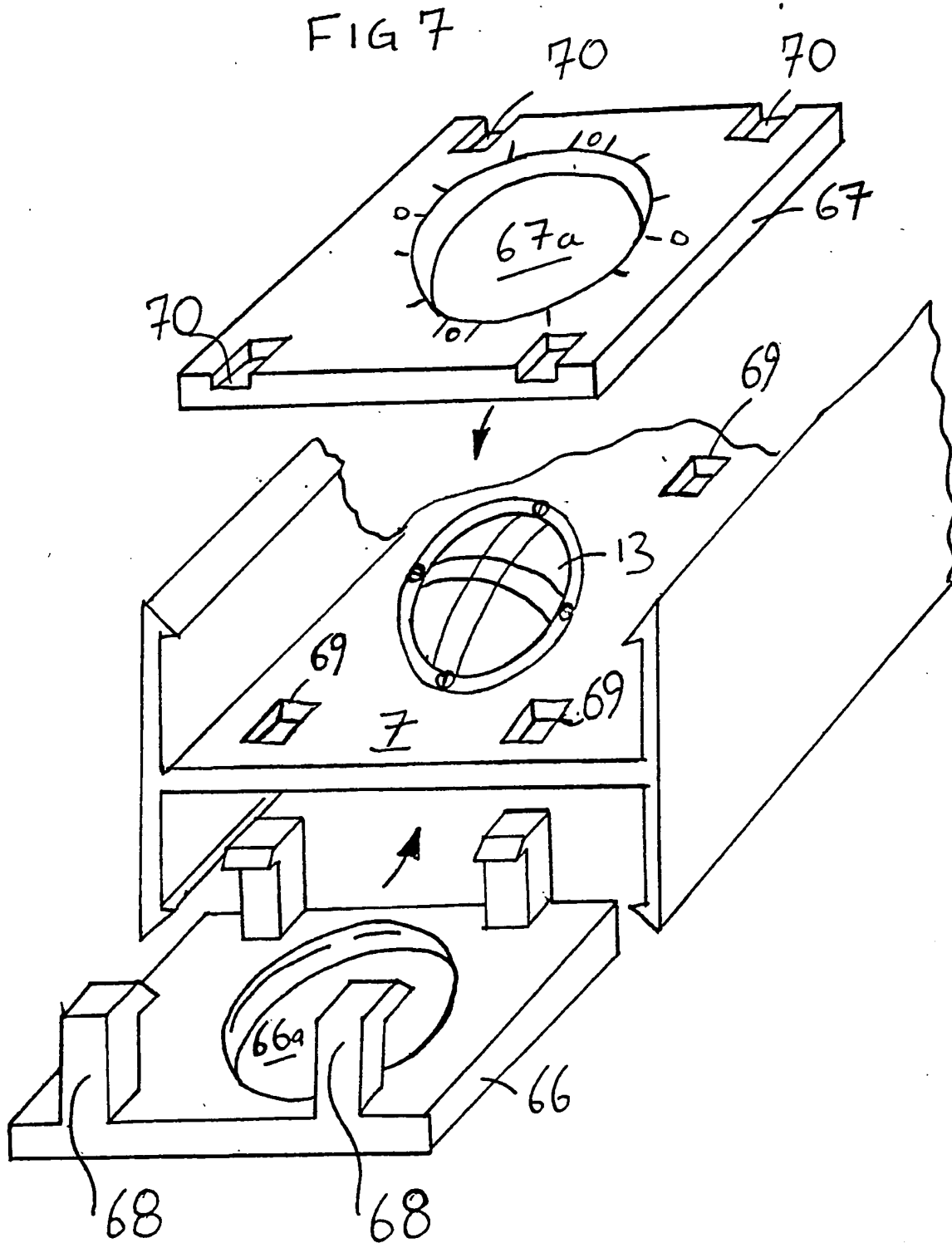


FIG 6





### Spirit Levels

The present invention relates to spirit levels.

Spirit levels are levelling instruments used to define a horizontal line or surface. Spirit levels generally consist of hermetically sealed tubes partially filled with an alcohol-based liquid, in such a way as to leave a visible air bubble. This air bubble is located midway along the tube when the latter is exactly in a horizontal orientation. This midway position can be marked on the tube directly or indirectly; for example, when the tube is mounted on an I-beam, the midway position may be adjacent to the edge of the tube on the beam.

Typically, a spirit level comprises an elongate beam having mounted thereon at least two tubes, one in horizontal and one in vertical orientation relative to the longitudinal axis of the beam. To set a horizontal line on a wall, a spirit level is placed against the wall with the top of the beam being placed adjacent to a first point and the beam is moved upwardly and downwardly around this point until the air bubble is in the exact midway position of the horizontally mounted tube. To set a vertical line, one edge of the beam is placed adjacent to a first point, and the beam is then moved either to the right or to the left about the first point until the air bubble in the vertically mounted tube is exactly midway in the length of the tube.

Conventional spirit levels have the disadvantage that only the vertical or the horizontal can be set at one time, using a vertically or horizontally mounted tube, respectively. I have now devised a spirit level having only one bubble container which is easy to handle and cheap to manufacture, which can be used to set both vertical and horizontal, and which can further be used to determine in simple manner angles between the vertical and the horizontal.

According to the present invention there is provided a spirit level comprising:

- a) an elongate frame member having a pair of opposed longitudinal edge portions and an intermediate connecting web;
- b) a sealed fluid container mounted on said web, which container has opposed internal surface portions, at least one of said portions being concave and smoothly curved in two mutually perpendicular directions, said container being partially filled with a fluid such that an air bubble is present in said container, markings being provided on said spirit level such that in use the position of said bubble relative to said markings can selectively indicate either orientation of said edge portions or of said web to the horizontal.

It is preferred that the web is substantially at right angles to the opposed edge portions.

Preferably, the container is disc-shaped, in which case it is preferred that a first set of markings are provided, associated therewith, at spaced-apart intervals around the edge of the disc. Advantageously, a second set of markings are provided preferably on the surface of the disc defining its centre point. In use, the first set of markings may be used with the bubble to determine the angular orientation of the edge portion to the horizontal or vertical, and the second set of markings to indicate the angular plane orientation of the web relative to the horizontal plane.

Preferably, the second set of markings provided on the disc are in the form of two pairs of lines, each pair comprising at least two substantially parallel lines, each pair being arranged to cross the other substantially at right angles, such that rectangular or square zone is defined having as its centre the centre point of the face of the disc.

When used to indicate plane orientation as described, the spirit level according to the invention preferably rests on its opposed elongate edge portions on the surface under examination.

The frame member is advantageously of metal (preferably aluminium, or an alloy thereof), which may be in the form of an extrusion.

It is preferred that the angular orientation of the disc-shaped container relative to the web is adjustable. In order to effect adjustability, the container is preferably mounted on an annular resilient ring, for example a rubber 'O'-ring, the disc being fixed to the web by means of adjustable screws passing through threaded holes provided on a peripheral rim of the disc, cooperating with like threaded holes provided in the web of the frame member.

Preferably, the disc is mounted on a template, bearing the first set of markings, which is mounted on the web. The first set of markings are generally provided at least at  $0^\circ$ ,  $90^\circ$ ,  $180^\circ$  and  $240^\circ$  positions around the disc relative to a horizontal or vertical axis of the frame member. Preferably, the disc is further divided into smaller angles.

The present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a part of an exemplary spirit level in accordance with the present invention;

Figure 2 is a perspective view of the spirit level of Figure 1 in a vertical orientation;

Figure 3 is a perspective view of the spirit level of Figure 1 in a horizontal orientation;

Figure 4 is a side view of the disc-shaped container of the spirit level of Figure 1;

Figure 5 is a side front view of the disc of Figure 4 in a vertical orientation; and

Figure 6 is an exploded view of a preferred means of securing the disc-shaped container of Figure 3 to a spirit level according to the invention; and

Figure 7 is an exploded view of a preferred means of securing a marking plate to a spirit level according to the invention.



Referring to the drawings, there is shown a spirit level comprising an elongate I-beam frame 1 having a base 3 and a top 5, and between the top and base a central web 7. On the central web 7, there is mounted a template 9 bearing markings 11. Disc 13 is located in an opening 15 of the template 9. The disc 13, as best seen in Figures 4 and 5, has two concave faces 15 and 17 and a flat peripheral edge 19. The disc is filled with a liquid 23 leaving an air bubble 25. In a horizontal orientation as shown in Figure 4 the air bubble 25 is in the radial central portion of the concave face 15. This central portion has markings 27, further markings being provided on template 9. Markings 29 and 31 are separated by the length of the air bubble and indicate  $0^\circ$  or  $180^\circ$ ; the opposite set of markings 33 and 35 indicate  $180^\circ$  or  $0^\circ$ . Further sets of markings 37 and 39 and 41 and 43 are located around the horizontal axis of the disc, at opposite sides. Additionally, single markings 45 are located midway between the sets of markings. The top 5 of the I-beam has an opening 47 located above the set of markings 29 and 31 for allowing easy visual access to the mounted disc.

The spirit level may either be used for indication of the attitude of a planar surface relative to the horizontal, or alternatively (similarly to a conventional spirit level) to give an indication of linear inclination along a straight line.

Where the level is used for the former purpose, the spirit level may be laid with its longitudinal edges 3 on a surface which needs, for example, to be adjusted into exact horizontal planar orientation. The surface may be moved upwardly or downwardly as required until the air bubble 25 is exactly located within the set of markings 27 as shown in Figure 1.

To define a vertical surface, the spirit level is laid on the surface, pointing vertically. If the surface is exactly vertical, the air bubble will be located between the set of markings 37 and 39 as shown in Figure 2.

To define a right angle between two abutting walls, for example, the spirit level is pressed with its base 3 against a first wall 51. The edge of base 3 and the edge of top 5 rest on the second surface 53. If these two surfaces 51 and 53 are perpendicular to one another the air bubble 25 of the disc 13 will be located in the radial centre 25 of the concave face 15 exactly in the middle of the applied markings of 27. This orientation is illustrated in Figure 3.

The liquid within the container is preferably alcohol although other suitable fluids may be used. To enhance the contrast, fluorescent colours may be added to the liquid. The preferred material for the discoid container is plastics although other materials could also be used. The template into which the container is placed may be metal, plastics, although a strong cardboard may sometimes be used. The I-beam may be made of plastics or metal although other suitable material, such as wood could also be used.

Referring to Figure 6, here the disc 13 is provided with four threaded holes 60 around a peripheral rim 61. Screws 62 pass through the holes 60 and engage with complementary threaded holes 63 provided through the web 7 of the I beam frame. The rim 61 rests on a circular rubber 'O'-ring 64 which becomes sandwiched between the disc 13 and web 7 as the screws 62 are tightened, and the disc 13 is received in the aperture 65.

Referring now to Figure 7 also, graduated marking plates 66 and 67 are provided capable of snap-fitting with one another on opposed sides of the web portion 7, with the disc 13 projecting through apertures 66a and 67a provided in the plates.

The snap fit is achieved by means of resilient projections 68 provided on the lower marking plate 66, projecting first through apertures 69 in the web 7 before being compressed through smaller apertures 70 in the upper marking plate 67 whereupon the projections return to their original dimensions engaging with the upper surface of the upper marking plate 67.

When the spirit level 1 is placed as shown in Figure 6 on a 'true' horizontal datum surface, the spirit level can be calibrated by individual adjustment of the grub screws 62, causing the orientation of the disc 13 to change relative to the web 7 as a result of the local resilience of the 'O'-ring 64.

Having thus been calibrated to give a 'true' reading on the reference plane (which requires the bubble to rest in the quadrilateral defined by the two sets of parallel markings on the surface of the disc), the marking template 9 can be fixed to the web 7 covering the screws 62.

Claims

1. A spirit level comprising:
  - a) an elongate frame member having a pair of opposed longitudinal edge portions and an intermediate connecting web;
  - b) a sealed fluid container mounted on said web, which container has opposed internal surface portions, at least one of said portions being concave and smoothly curved in two mutually perpendicular directions, said container being partially filled with a fluid such that an air bubble is present in said container, markings being provided on said spirit level such that in use the position of said bubble relative to said markings can selectively indicate either orientation of said edge portions or of said web to the horizontal.
2. A spirit level according to claim 1, wherein the web is substantially at right angles to the opposed edge portions.
3. A spirit level according to claim 1 or claim 2, wherein the container is substantially disc-shaped.
4. A spirit level according to claim 3, further comprising means for adjustment of the angular orientation of the disc-shaped container relative to the web.
5. A spirit level according to claim 3 or 4, wherein markings are provided, at spaced apart intervals, around the edge of the disc.
6. A spirit level according to any of claims 3 to 5, wherein markings are provided on one surface of the disc defining the centre point of said surface.

7. A spirit level according to any preceding claim wherein the frame member is of aluminium alloy.
8. A spirit level according to any preceding claim, wherein the frame member is an extrusion.
9. A spirit level substantially as described herein with reference to the accompanying drawings.

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